

Quantum Field Theory for Philosophers

(Shortened version of summary)

Introduction

1) QFT as a guide to metaphysics

2) Classical concept of Field
Field v. Particle theory

slide (1)

3) What do we mean by an individual? - TI

4) Field approach to classical Particle Physics

slide (2)

10 min 5) Quantum Field Theory
Two approaches!

Field Quantization

Second quantization

Fock space

slides (3) (3a) (3b) (3c)
slide (4)

creation / annihilation operators

12 min 6) 'real' field \rightarrow first quantization
repeated S.E. \rightarrow 2nd quantization \rightarrow Quantum Field
slide (7)

20 min 7) Is Quantum Field same covered in 2 cases (slide 8)
however 1) Real field v. complex field

2) Born - classical field limit
v. Fermi - Dirac limit

3) massive fields (non Goldstone) v. massless fields

4) Weyl fermions

5) Causality conditions

\rightarrow Spin-Statistics Theorem

But parafields

slide (10)

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A complete harmony between the wave
and light-quantum descriptions of
the interaction [between atoms and
electromagnetic waves]

2) Creation & annihilation operators in canonical notation
slide (11)
Kalam - Mutakallim

30 min 8) Wave-particle Duality - No. does not commute with $2(2,1) \propto Q(x)$.

* Due Date

35 min 9) Notes on Free fields slide (12)

of Bootstrap programme: says that, QFTs
superficially, implication of good 'model'

10) What do we mean by renormalization?
E/H. v. says they renormalize

40 min 11) The Problem of individuality
elem. particles do not possess TI \rightarrow no individuality
Stat. mechanical argument. slides (13), (14)

limitation on secondality of states of TI is assumed.

12) Indistinguishability Principle slide (15)
restriction on observables \rightarrow para-statistics
" " states \rightarrow Bosons/Fermions only

Connection between para particles & parafields
space-temporal continuity of trajectory & individuality
Vacuum, virtual particles

50 min 13) Vacuum $N_0 = 0$, fluctuations on $Q(2)$ etc

explains Lamb shift etc - Casimir effect
of extended particle interpretation.

14) Virtual particles Expand $|\Phi\rangle = |\Phi\rangle +$ virtual particles
 $1b + 1b'$ added in terms of 1b solutions slide (16)